Saskatchewan

A D F

Agriculture Development Fund

FINAL REPORT

SWINE MANURE TANKER TRUCK INJECTOR SYSTEM FOR MANURE RESEARCH AND DEMONSTRATION

19990054

Funded by
The Agriculture Development Fund

January 2000
Prepared by: PAMI

SAF
SASKATCHEWAN AGRICULTURE & FOOD
Adding value to agriculture...through research and development

102-00330/

Project No. 4300GF
Date: November 2000
Tested at Humboldt

ADF#99000054

Final Report

Swine Manure Tanker Truck Injector for Manure Research and Demonstration

Wayne Stock, A.Sc.T.
Assistant Manager
Soils and Crops

Gordon Hultgreen, P.Ag.
Manager
Soils and Crops

Philip Leduc, P.Eng.
Senior Manager
Research and Development

James Wassermann, P.Eng.
Vice President
Saskatchewan Operations

Acknowledgement

PAMI wishes to acknowledge the funding support provided by the Agriculture Development Fund of the Saskatchewan Department of Agriculture and Food and Sask Pork for the majority of funding to develop the manure tanker truck injector system.

Table of Contents

Page

1. Introduction 1

2. Project Objective 2

3. Project Description 3
   3.1 Manure Truck Design Parameters 3

4. Results and Conclusion 5

5. Photos 9

1. Introduction

With a large land mass and low rural population, Saskatchewan has the potential to greatly expand pork production. In order to assist the development of the industry, research and demonstration is required to ensure the environmental safety of manure application. PAMI in cooperation with the U of S and other agencies has been conducting manure application research and demonstration trials since 1996. However the equipment rented or borrowed for the application was inefficient leading to costly manure application trials. The machinery required included a semi to transport the tractor and tank plus a ¾ ton truck to transport the injector. In addition a sewer pumping truck was required at each site to supply the swine manure. This equipment set-up in the field was inefficient and therefore costly to use and limited the number and location of research and demonstration sites. The development of a self-contained manure tanker/injection system will increase the efficiency of manure application, reduce costs and allow the addition of extra research and demonstration sites.

2. Project Objective

The object of the project was to develop a liquid manure application system to efficiently apply swine manure to research and demonstration sites throughout Saskatchewan.

3. Project Description

After studying a number of alternatives it was decided that the best option for applying swine manure to research and demonstration plots was to develop a truck-based system with vacuum/pressure tank. The truck would have the capability of traveling long distances, be able to pump swine manure directly from the earthen manure storage to the truck and be able to apply swine manure using either low or high disturbance injection. In addition the truck is capable of variable rate manure application using GIS/GPS.

3.1 Manure Truck Design Parameters

1. Truck – A 1994 Mack semi-trailer truck with the fifth wheel removed was purchased for the project. The frame was stretched to handle a large manure tank. A low speed auxiliary transmission was added to allow field ground speeds as low as 1 mph. An electrically controlled governor was added to accurately maintain ground speed in the test plots. Wide tires were added to the front axle to improve in field flotation. A computer controlled tire pressure system is used to lower tire pressure in the field and on secondary roads to reduce field compaction and road damage.

2. Tank - A 2700 Imperial gallon pressure/vacuum tank with a vane pump was purchased from Smith Industries for the project.

3. Hydraulic Systems – Hydraulics systems are driven from the front of the crankshaft with an electric clutch between the crankshaft and pumps. The hydraulics are controlled by electric solenoids from the truck cab and they drive the vacuum pump, raise and lower the tool bar, operate the spinner in the manure distributor manifold and operate the on/off manure valve. Down force on the tool bar can be adjusted for constant injection depth.

4. Toolbar – A 3-rank, 10-foot wide toolbar is attached to the back of the truck with a parallel link system. The toolbar can be equipped with high disturbance shanks and shovels or with low disturbance disc systems for operation in conventional or zero till conditions as well as in pasture. Row space can be changed to accommodate project requirements.

5. Manifold – A GreenTrac distribution manifold is used for even manure distribution over a wide range of manure application rates. Application rates can be changed by changes in ground speed, by flow control valve settings or by orifice change.

6. Sanitation – A gas powered high-pressure washer and 100 Imperial gallon tank is attached to the truck for cleaning and disinfecting.

7. Electronics – A Dickey-John Land Manager GIS/GPS system controls the manure application rate by measuring the manure flow with a magnetic flux flow meter and controlling the plug valve opening. Ground speed is monitored by radar and a differential GPS receiver supplies field location. The system is capable of applying variable rate manure using the GIS/GPS system.

The truck injector system was completed in fall of 2000 and all manure application research plots were applied using the new machine. Both high disturbance and low disturbance plots were applied successfully with the new system. A few modifications to the toolbar have been made to improve field performance.

The machine was on display for PAMI's 25th Anniversary celebration on November 17, 2000.

4. Results and Conclusion

The injector truck is now in service and is used for all swine manure plot research conducted by PAMI in Saskatchewan. Discussions are in the planning stage with Sask Pork for expanding the use of the machine by conducting swine manure application demonstrations in addition to the research activities. The machine will be available for all future research and demonstration requirements that are needed to assist the sustainable development of the hog industry in Saskatchewan.

8. Project Photos

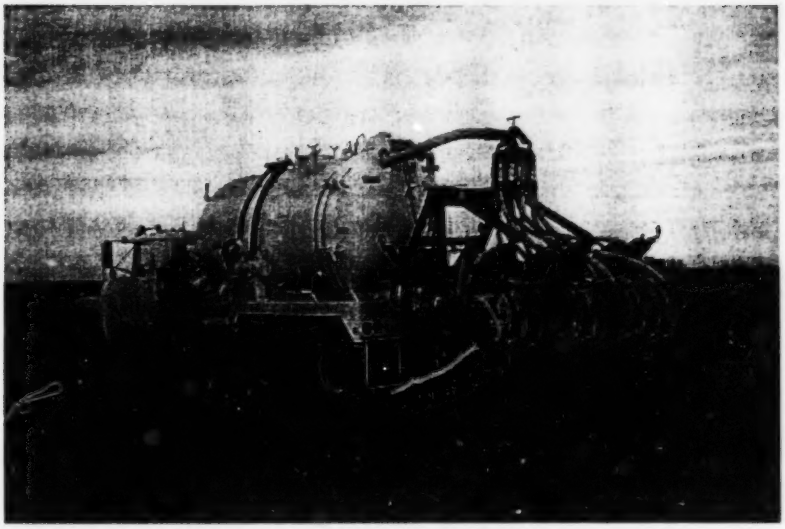

Figure 1. Completed Manure Tanker Truck Injector.

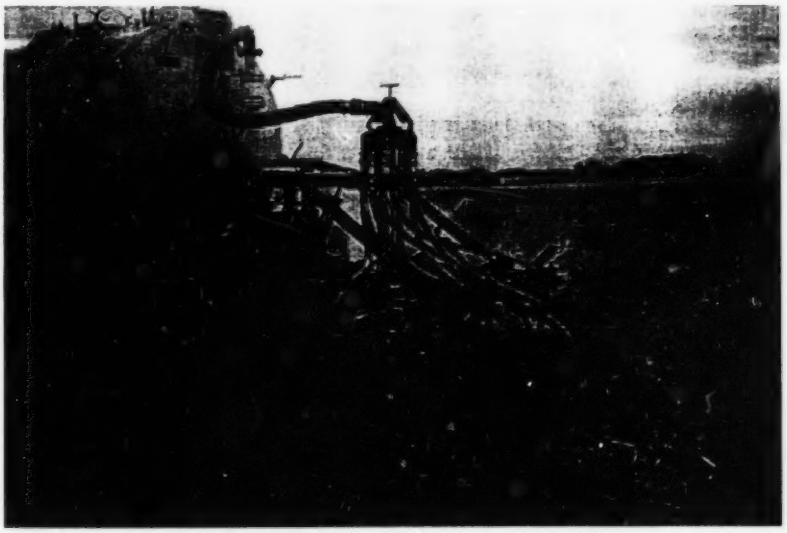

Figure 2. High Disturbance Injector with Shanks and Sweeps.

Figure 3. Low Disturbance Injector with Coulter Openers.

Figure 4. Low Disturbance Application of Manure to Cereal Stubble.